in the art will understand that it is also acceptable for the material to first be shaped into the desired preform followed by application of the toughening agent.

[0030] An untoughened resin may then be applied to the entire preform. In one embodiment, the untoughened resin may comprise a resin selected from the group consisting of vinyl ester resins, polyester resins, acrylic resins, epoxy resins, polyurethane resins, bismaelimide resins, polyimide resins, and combinations thereof. The untoughened resin may be the same as, or different from, any untoughened resin previously used in combination with a toughening agent to produce the toughened resin. Any conventional resin application methods may be used herein to apply the untoughened resin to the preform.

[0031] The preform having the applied untoughened resin may then be cured to produce an article, such as fan casing **16**, shown in FIG. **7**. Curing can generally involve applying a resin to the material or preform, as previously described, followed by exposure of the resinated preform or material to high temperature and pressure. Any conventional curing process known to those skilled in the art is acceptable for use herein. Some examples of curing may include, but are not limited to, resin film infusion, resin transfer molding, and vacuum assist resin transfer molding.

[0032] As shown in FIG. **7**, the resulting cured composite material **46** of fan casing **16** can have at least one toughened region **48**, at least one untoughened region **50**, and a transition region **51** between each toughened region **48** and untoughened region **50**. As used herein, "untoughened region" **50** means an area of composite material **46** generally corresponding to the portion of the material comprising the untoughened resin **43**. "Toughened region" **48** means an area of the composite material generally corresponding to the portion of the material comprising the toughened resin **44**. Toughened region **48** can display an increased resistance to fracture when compared to untoughened region. Those skilled in the art will understand that toughened region **48** can generally correspond to portions of the material where the toughening agent was applied due to previously described interaction between the toughening agent and the untoughened resin. Toughened region **48** may be oriented in any in relation to fan casing **16**.

[0033] Transition region **51** can generally be located between toughened region **48** and untoughened region **50** and can display varying degrees of toughness in order to facilitate the conversion between toughened region **48** and untoughened region **50**. Moreover, those skilled in the art will understand that transition region **51** may be planar (as indicated by A in FIG. **7**), normal to the plane (as indicated by B in FIG. **7**), and combinations thereof, in relation to the fan casing, for example.

[0034] Additionally, in one embodiment shown in FIG. **7**, fan casing **26** may comprise an impact zone **52** and a non-impact zone **54**. "Impact zone" **52** refers to parts of fan casing **16** most susceptible to an impact from a released fan blade while "non-impact zone" **54** refers to parts of fan casing **16** that are less susceptible to impact damage from a released fan blade. It may be desirable to position untoughened region **50** in impact zone **52** to provide controlled resin microcracking and composite material ply delamination, both of which can facilitate the previously discussed dissipation of impact energy from a released fan blade. In contrast, it may be desirable to position toughened region **48** in a non-impact zone **54** as such areas can be more fracture resistant. Additionally, because toughened region **48** of fan casing **16** can have a reduced structural thickness compared to current fan casings, yet still provide the desired fracture resistance, fan casing **16** can have a reduced weight compared to current designs. Thus, exemplary embodiments may employ toughened and untoughened regions to provide controlled failure and weight reduction.

[0035] Additionally, the selective toughening concept described herein can also provide monetary savings. In general, toughened resins (i.e. those resins including toughening agents) are more costly than untoughened resins. However, to obtain the desired fracture resistance, multiple layers of composite material having untoughened resin must be used, which can increase the cost of fabricating the article. By using toughened resins only in select regions where increased fracture resistance is needed, and untoughened resin elsewhere, fewer layers of composite material are needed. This can lead to an overall cost savings in fabricating the article.

[0036] Optionally, at least one toughened flange **56** may be coupled to toughened region **48**. Toughened flange **56** may be selected from the group consisting of mounting flanges, attachment end flanges (as shown in FIG. **7**), and combinations thereof "Toughened flange" **56** refers to a flange that can be fabricated from the same, or similar, materials as toughened region **48** of fan casing **16**. More specifically, toughened flange **56** can be made from a composite material having a toughening agent applied to at least a portion thereof, as described previously herein. In addition, toughened flange **56** may be coupled to a toughened region **48** of fan casing **16**. By "coupled" it is meant that the toughened flange may be operably connected to the fan casing either after the lay-up of the fan casing preform is complete, or concurrent with the lay-up of the fan casing such that the toughened flange is an integral part of the finished cured fan casing. Using toughened materials to construct toughened flange **56** can provide added strength to both flange **56**, as well as to the attachment between flange **56** and toughened region **48**.

[0037] Those skilled in the art will understand that the previous description may apply equally to making any composite materials, and articles made from composite materials, and should not be limited to fan casings. Indeed, any gas turbine engine component constructed from composite materials may be fabricated using the methods and materials described herein. For example, the previous description may be used to fabricate a composite material airfoil having at least one toughened region and at least one untoughened region.

[0038] This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to make and use the invention. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

What is claimed is:

1. A method of making an article having at least one toughened region and at least one untoughened region comprising:

providing a material;

applying a toughening agent to a portion of the material;

shaping the material to produce a preform;

applying an untoughened resin to the preform; and